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Opposition against European Patent 1 033 347 B1
European Patent Application No. 98 941 672.2
Title: "Hollow fine powder, flaky fine titanium oxide powder prepared by pulverizing said hollow fine powder ..."
Proprietors: Ishihara Sangyo Kaisha, Ltd., et al.
Opponent: Dr. Nicolaus ter Meer
Case: OPJH-013EP

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In the name of

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an **opposition** against the grant of the above-identified patent is herewith filed.

The Opposition Fee of **635 EUR** is paid with the enclosed cheque.

A. Requests and Grounds for Opposition

It is requested to revoke the patent in its entirety according to Article 101 (2) EPC. Oral proceedings are requested by way of an auxiliary request in accordance with Article 116 (1) EPC.

The opposition is filed on the ground that the subject-matter of the European patent EP 1 033 347 B1 (hereinafter referred to as opposed patent) is not patentable within the terms of Articles 52 to 57 EPC (Article 100 (a) EPC). In particular, the subject-

matter of the patent lacks novelty (Article 54 EPC) and inventive step (Article 56 EPC).

The opposition is also filed on the ground that the European patent does not disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art (Article 100 (b) EPC).

The opposition is further filed on the ground that the subject-matter of the European patent extends beyond the content of the earlier application as filed (Article 100 (c) EPC).

B. Facts and Reasons

I. Documents Cited

The following documents are cited in the opposition:

- D1: Groult et al., "Nouveaux oxydes à structure en feuillets: Les titanates de potassium non-stoechiométriques $K_x(M_yTi_{2-y})O_4$ ", Journal of Solid State Chemistry, 32, 289-296 (1980)
- D2: JP 06-122518 and English abstract thereof
- D3: JP 09-25123 and English abstract thereof
- D4: EP 0 601 594 A1
- D5: JP 61-118311 (English abstract)
- D6: JP 09-227122 (English abstract)

II. The Opposed Patent

1. Priority

The opposed patent was filed on September 02, 1998. It claims seven priorities: JP 25426697, filed on September 02, 1997; JP 25426797, filed on September 02, 1997; JP 25426897, filed on September 02, 1997; JP 36490897 filed on December 18, 1997; JP 36490997, filed on December 18, 1997; JP 3054198, filed on January 27, 1998; JP 3054298, filed on January 27, 1998.

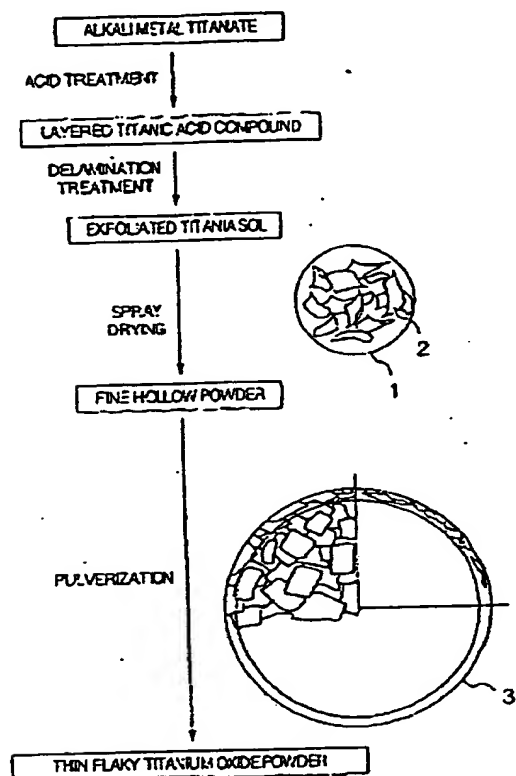
2. Claims

The opposed patent comprises 21 claims.

Claim 1 relates to a fine hollow powder. Further claims of the opposed patent are directed to starting materials for the production of the fine hollow powder, a process

for producing the fine hollow powder and a thin flaky titanium oxide powder obtained by pulverization of the fine hollow powder.

An overview of the claimed subjects is given in figure 1 of the opposed patent.



In the following table the subject-matter of the independent claims is summarized.

Claim	Subject-matter
Claim 13	Alkalimetal titanate
Claim 15	Layered titanic acid compound
Claim 7	Exfoliated titania sol
Claim 1	Fine hollow powder
Claim 16	Thin flaky titanium oxide powder
Claim 4	Process for producing fine hollow powder by spray drying an exfoliated titania sol (claim 7 --> claim 1)
Claim 18	Process for producing the thin flaky titanium oxide powder by pulverizing the fine hollow powder (claim 1 --> claim 16)

III. Grounds for Opposition according to Article 100 EPC

1. Added Subject-Matter (Article 100(c) EPC)

According to Article 123(2) EPC a European patent must not be amended in such a way that it contains subject-matter, which extends beyond the content of the application as originally filed.

Present claim 1 relates to a "fine hollow powder comprising a titanium oxide shell with laminated oxide particles stuck together."

However, the feature "laminated oxide particles stuck together" was not directly and unambiguously disclosed in the application as originally filed.

The only passage relating to "stuck particles" in the application as originally filed is section [0020] of EP 1 033 347 A1, which reads as follows:

"In the present invention, the fine hollow powder can be produced by spray drying an exfoliated titania sol, and its formation mechanism can be presumed as follows. As shown in Fig. 1, the sprayed laminated titania sol takes the form of fine liquid droplets 1, which are immediately thereafter exposed to high temperatures for drying. Evaporation of water takes place not only on the surfaces of the liquid droplets, but also in the inside space due to rapid heating of the liquid droplets as whole, causing to inflate as balloons and dry at the same time. Thus, laminated particles 2 are stuck with one another to form a fine hollow powder 3 having an outer diameter of 0.1 - 5,000 μm ."

It can be seen that section [0020] of the application as filed does not disclose the feature "laminated oxide particles stuck together" directly and unambiguously. Instead, in said passage only some kind of "formation mechanism" is presumed. In addition, it is noted that the term "laminated particles 2 are stuck with one another to form a fine hollow powder 3" is only disclosed

- a) in connection with a particle size of 0.1 to 5000 μm and
- b) in connection with a spray drying process.

Contrary thereto, independent claim 1 of the opposed patent describes laminated oxide particles stuck together irrespective of their particle size and irrespective of their method of production.

Consequently, the subject-matter of claim 1 extends beyond the content of the application as originally filed and the opposed patent does not meet the requirements of Article 123(2) EPC.

2. Insufficient Disclosure (Article 100(b) EPC)

A European patent must disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art. According to the established jurisprudence of the Boards of Appeal the disclosure is only sufficient if it allows the invention to be performed **in the whole range claimed** rather than only for some members of a claimed class. Sufficiency of the disclosure thus presupposes that the skilled person is able to obtain substantially **all** embodiments falling within the ambit of the claims without undue experimentation (see for example **T 409/91**, section 3.5).

The opposed patent claims a fine hollow powder comprising a titanium oxide shell having an outer diameter of 0.1 to 5,000 μm , see section [0020] of the opposed patent. The fine hollow powder is made by spray drying. However, no detailed process conditions for the spray drying step are disclosed in the opposed patent. Only in Example 10 the production of a fine hollow powder having an outer diameter of 20 μm is described.

A person skilled in the art knows that generally spray drying results in particles ranging from several microns to several hundred microns in size. However, without specific guidance it is impossible to produce hollow particles having an extremely small outer diameter of 0.1 μm or an extremely large outer diameter of 5,000 μm . The opposed patent does not provide any guidance how extremely small or extremely large hollow particles can be produced by spray drying.

For this reason, the patent does not meet the requirements of Art. 83 EPC since the teachings thereof cannot be performed over the whole range claimed without an undue burden of experimentation.

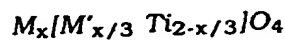
3. Lack of Novelty (Article 100(a) and Article 54 EPC)

The subject-matter of the opposed patent is not novel.

3.1 Claim 13

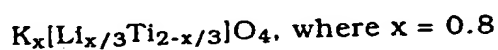
Claim 13 relates to

"A mixed alkali metal titanate in an orthorhombic layer structure represented by the following composition formula:

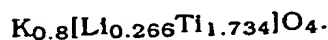


, where M and M' are mutually different kinds of alkali metals and x is 0.50 - 1.0."

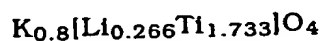
The subject-matter of claim 13 is further illustrated in section [0070] of the opposed patent, wherein a mixed alkali metal titanate having the formula



is described. When 0.8 is substituted for x, the following mixed alkali titanate is derived:



However, the above mentioned mixed alkali titanate is already known from document **D1**. The attention of the opposition division is drawn to page 295, right column, line 24, where a titanate of the formula



is explicitly mentioned.

The identity of the titanate of **D1** and of the titanate according to claim 13 can also be derived when comparing the lattice constants. In section [0044] of the opposed patent the following lattice constants are given:

$$a = 3.8244(3)\text{\AA}$$

$$b = 15.534(1)\text{\AA}$$

$$c = 2.9733(1)\text{\AA}$$

Taking into account the usual error of measurement virtually the same lattice constants are disclosed on page 295, right column, lines 25 and 26 of D1:

$$a = 3.831 \text{ \AA}$$

$$b = 15.584 \text{ \AA}$$

$$c = 2.976 \text{ \AA}$$

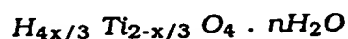
Furthermore, document D1 discloses on page 295, right column, lines 27 to 29 that "lithium is absent between the layers (M_2O_4)", which corresponds to the description of the opposed patent "interlayer alkali metal ions (M) and host framework alkali metal ions (M') in section [0040] of the opposed patent. Accordingly, in the mixed alkali metal titanate according to claim 13, potassium (corresponding to M) exists between the layers, while lithium (corresponding to M') exists in the host framework.

To summarize, document D1 clearly anticipates a mixed metal titanate as described in claim 13. Hence, the subject-matter of claim 13 is not novel over the disclosure of document D1.

3.2 Claim 15

Claim 15 concerns:

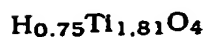
"A layered titanate compound in an orthorhombic layer structure represented by the following composition formula:



, where x is 0.50 - 1.0 and n is 0 - 2."

Document D2 discloses a layered rhombic crystal of the formula $H_xTi_{2-x/4}O_4 \cdot nH_2O$, where x is from 0.6 to 0.75 and n is from 0 to 2; see English abstract and section [0003] of the full text.

When x is 0.75, the above formula describes a titanate compound of the formula



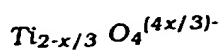
A titanate compound of the formula $H_{0.75}Ti_{1.81}O_4$ corresponds to the claimed titanate compound when $x = 0.5625$.

To summarize, document D2 clearly discloses a layered titanate acid compound as claimed in claim 15. Hence, the subject-matter of claim 15 is not novel over the disclosure of document D2.

3.3 Claim 7

Claim 7 relates to

"An exfoliated titania sol, which comprises a dispersion of delaminated particles represented by the following composition formula:



, where x is 0.57 - 1.0."

Document D3 discloses a titania sol comprising a compound of the formula $\text{Ti}_{2-x/4} \text{O}_4^x$, wherein $x = 0.75$. For a skilled person the term "0.75" comprises values ranging from 0.745 to 0.754.

Reference is made to **T175/97**, Reasons 2.6:

"In diesem Zusammenhang muss jedoch angenommen werden, dass der Fachmann bei der Interpretation und Umrechnung von Zahlenangaben, die sich auf Messgrößen beziehen, nicht eine beliebige oder willkürliche Genauigkeit zugrundelegen würde, sondern sich vielmehr der Tatsache bewusst ist, dass technische Zahlenangaben mit einem Messfehler behaftet sind, der letztlich die sinnvolle Rechengenauigkeit begrenzt. In der naturwissenschaftlich-technischen Literatur gilt daher die Konvention, dass die letzte angegebene Stelle von Zahlenwerten der Messgenauigkeit entspricht. Dabei ist in Ermangelung genauer Fehlergrenzen der Maximalfehler aus der Rundungskonvention für die letzte angegebene Stelle abzuschätzen. Solange es sich nicht um offensichtlich unsinnige Genauigkeitsangaben handelt, wird der Fachmann bei der Interpretation von Wertebereichen in Patentschriften von denselben Annahmen ausgehen, da auch diese technische Sachverhalte zum Inhalt haben und nur so eine technisch sinnvolle Auslegung des Schutzbereiches möglich ist."

If x is 0.754, the resulting compound has the formula $\text{Ti}_{1.812} \text{O}_4^{-0.754}$. This compound anticipates the subject-matter of claim 7, because when x is 0.565, (which is comprised by the value $x=0.57$) then a compound of the formula $\text{Ti}_{1.812} \text{O}_4^{-0.753}$ is claimed.

In addition, the sol of D3 is "dispersed by stirring to form the thickness of a monolayer order", i.e. D3 describes an exfoliated titania sol.

Consequently, the subject-matter of claim 7 is not novel over the disclosure of document D3.

3.4 Claim 1

The subject-matter of claim 1 is not novel over document D4 since D4 discloses microballoons of inorganic material (e.g. titanium oxide). The microballoons are obtained by evaporating a liquid medium comprising an inorganic material, wherein the inorganic material sinters or fuses to form the crystalline microballoons, see abstract of D4 and page 2, lines 45-51.

The term "microballoons" anticipates the feature "fine hollow powder". Furthermore, the microballoons are formed by sintering or fusing particles, i.e. particles are stuck together.

As a consequence, Document D4 discloses all features of claim 1 and the subject-matter of claim 1 does not fulfill the novelty requirement.

4. Lack of Inventive Step (Article 100(a) and Article 56 EPC)

The subject-matter of the opposed patent is not based on an inventive step.

4.1 Product Claims 13, 15 and 7

As shown above in section B-III, 3. of this writ, the Opponent has provided clear and convincing evidence, that the subject-matter of claims 13, 15 and 7 is not novel in view of documents D1, D2 and D3, respectively.

It is submitted that even if certain features of the claimed subject-matter should not be considered by the Opposition Division to be identical in every detail with those of the cited prior art documents (D1, D2 and D3, respectively), these differences would be in any case very minor and consequently not sufficient to impart an inventive step to the claimed subject matter. Therefore, Opponent reserves in accordance with **T 131/01** the right to substantiate the ground of lack of inventive step according to the problem-solution-approach in more detail, at least when the Opposition Division makes clear which feature of the claimed subject-matter has to be regarded as not disclosed by the cited prior art.

See headnote of T 0131/01:

"... a specific substantiation of the ground of lack of inventive step is neither necessary [...] nor generally possible without contradicting the reasoning presented in support of lack of novelty."

4.2 Product claim 16

Product claim 16 relates to a pulverized powder according to claim 1. However, the powder according to claim 1 has been known in the art, see above paragraph B-III, 3.4. Furthermore, pulverizing a powder is also known in the art. Hence, claim 16 cannot be based on an inventive step.

4.3 Process Claims 4 and 18

Process claim 4 is directed to a spray drying process of an exfoliated titania sol for producing a fine hollow powder according to claim 1.

However, spray drying of a titania sol was already known in the art, see document D5:

"The spherical titanium oxide can be produced by spray draying of a titania sol".

Consequently, the subject-matter of claim 4 is not based on an inventive step.

Process claim 18 relates to the pulverization of the powder according to claim 1. However, the powder according to claim 1 has been known in the art, see above paragraph B-III, 3.4. Furthermore, a conventional pulverizing step is also known in the art. Hence, claim 18 cannot be based on an inventive step.

4.3 Dependent claims

Also, the subject-matter of the dependent claims is not able to impart an inventive step.

Claims 2 and 3 are directed to a fine hollow powder comprising conventional particle sizes.

Process claim 5 is characterized by using as a raw material a titania sol comprising a customary viscosity.

Process claim 6 concerns a process, wherein the sol according to claim 7 is used as raw material. However, as shown above the sol according to claim 7 is neither novel nor inventive.

Process claim 8 is characterized by using as a raw material a titania sol having a usual particle size.

Process claim 9 only comprises a customary heat treating step.

Process claim 10 is not inventive in view of D6. D6 describes a process for producing a titanic acid by contacting a mixed alkali metal titanate with an acid compound. It is noted that D6 is published on September 2, 1997, i.e. on the earliest priority of the opposed patent. However, claims 4 and 10 can only validly claim the priority of December 18, 1997 since the spray-drying step is not disclosed in the first three priority applications dated September 2, 1997. Hence, the disclosure of D6 is prior art for claims 4 and 10. In addition, claim 10 is not inventive in the light of D2.

Process claims 11, 12 and 14 are dependent on claim 10 and describe the use of an alkali metal titanate and titanic acid as described in claims 13 and 15, respectively. However, as shown above the alkali metal titanate and titanic acid according to claims 13 and 15, respectively, are neither novel nor inventive.

Product claim 17 is dependent on claim 16 and describes a titanium oxide powder having a customary nanoparticulate particle size.

Process claim 19 is dependent on claim 18 and as additional feature only employs a conventional heating step.

Claims 20 and 21 describe customary uses for the known particles of claims 16 and 1, respectively.

5. Summary

As has been shown above, the subject-matter of the opposed patent does not meet the requirements of Articles 54 and 56 EPC. Furthermore, the requirement of a sufficient disclosure is also not fulfilled. Finally, the opposed patent contains added subject-matter.

Therefore, the request to revoke the opposed patent in its entirety is fully justified.



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European Patent Attorney

- Association No. 6 -

Enclosures:

Copies of documents D1-D6